

AVIATION

The Oldest American Aeronautical Magazine

AUGUST 29, 1927

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Air photo of the Oakland Airport taken Aug. 12 and showing all the Dole Derby entries

(Legend in Oakland Publishing Company)

VOLUME
XXIII

SPECIAL FEATURES

NUMBER
9

GERMAN AIR TRANSPORT
THE WESTERN AIR EXPRESS
DURALUMIN—DEFECTS AND FAILURES

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TULSA, OKLAHOMA

August 29, 1937



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- Divided and Forged Aluminum Main Crankcase
- Gearing of all accessories at the rear of the engine
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It is a ten-passenger, cabined transport monoplane with tank capacity for five hours' fuel. The power is furnished by three Wright Whirlwind engines giving a total of 645 horsepower.

The entire plane is built of duralumin, a copper-aluminum alloy as strong as structural steel but only one-third as heavy. The plane is weather-proof and needs only to be kept clean to prevent corrosion even though left out-of-



doors for long periods. This has been proved in actual practice.

Every part of the monoplane is replaceable direct from factory stock. One of the many advantages of its metal construction is that replacement parts fit. All sections are simple in outline, easy to repair and every rivet in the plane can be inspected. We know of no other plane which allows inspection of the rivets of the wings without taking off the covering. Ease of inspection in the Ford monoplane is further evidence of continued safe operation.

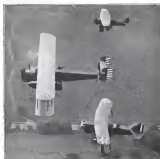
The landing gear is of striking interest. The most modern shock-absorbing equipment, rubber discs and oleo cylinders, is built in. The

wheel tread is sixteen feet five inches. Each wheel has a brake which operates independently of the other. These not only shorten the run after landings, but also facilitate cross and down wind taxiing and reduce the number of men required for ground handling.

Here we can give but the barest description of the plane. However, in our new booklet of more than thirty pages—"The New Era of Transportation"—you can learn what this advanced ship really is, and what it has done. We suggest you write for this booklet. It contains, in addition, much valuable information on forming and operating airlines—information based on experience on the Ford ships. And any other information you wish on technical, experimental, construction and operation work of Ford ships will be gladly furnished.

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With the Editor

DURING the months of May, June and July, 1937, the Western Air Express, Inc., which operates between Salt Lake City, U., and Los Angeles, Calif., transported 49,783 lb. of mail for a total distance of 108,460 mi. and was paid \$489,179.08. A study of the monthly figures, of this company, that appeared on page 413 of last week's issue of AVIATION will show that the number of pounds of mail carried and the revenue realized increased with each month although during the month of June the company flew over 1,400 miles less than it did during May and July.

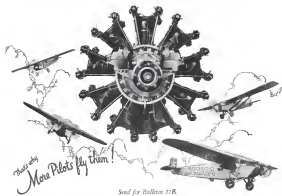
On page 474 of this issue is to be found an article on the Western Air Express written by Earl D. Osborn. The article is the result of a recent visit to the company's headquarters and flights over the route. It develops in a most interesting way the company's operations, its personnel and the territory it flies.

CONSISTENCY!

The Lindbergh, Chamberlin, Maitland and Byrd flights had one common factor—the Wright Whirlwind Engine.

The consistent selection of this engine by these world-famous fliers—as well as by many others whose page in history is not yet written—is equalled only by the flawless operation of the engine, whose uniform performance had played a major part in these epochal events.

This choice was not haphazard. It was logically based upon the actual performance of the engine itself. Its record of over 4,635,000 miles flown during 1926, in civil and military service, is alone sufficient to justify universal confidence.



WRIGHT

AERONAUTICAL CORPORATION

Patterson, N. J., U. S. A.



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Wings

AT TENSELY interesting and highly instructive pictorialization of the military side of aeronautics is to be found in the new Paramount screen production "Wings." Much has been said and written about war in the air. Some of which was actual truth, and some of which were the dreams of a highly imaginative author. But practically all of which was difficult indeed for the layman to understand, much less picture in his own mind. But in "Wings" he is able to see for himself just how war fliers operate, dress, in pairs and in squadrons. Not only does he see how the armies operate but also above the clouds but also how he "appears" the troops on the ground. To the man in the street and the post-war pilot, "Wings" is pictorial history, and to the aviator who was over there, it is like living the old days over again.

True, the planes that appear in the picture are some of the present day types, located, together with their personnel, through the courtesy of the U. S. Army Air Corps, which played no small part in making the production the success that it is. And when the war pilot sees the hero take off in the familiar "Spad" and two minutes later "die fighting" in a Curtiss "hawk", or sees the hero seal a "Gotha" down in flames, when in truth it is a post-war Martin bomber that goes down, he may smile in himself and think of R. E. in old Cowles and Fokkers, etc., but he experiences the old lack of half faith, half exaltation and grips the arm of his seat in suspense just as much as the novice who is sitting next to him and learning all about the art of aerial warfare for the first time.

The Famous Players-Lasker Corp., and all other organizations, as well as individuals who assisted in making "Wings," are to be congratulated for their spirited efforts and results. During the last year the people of this country have learned a lot about the value of the airplane in time of peace, and with the Air Corps becoming a stronger arm of defense with each new day it is altogether fitting that the non-flying public should have the opportunity to obtain some idea as to the true value of the airplane in time of conflict.

The Pacific Tragedy

THE RESIDENT of the house of life in connection with the Dole San Francisco Hawaii flight is having a sobering effect on the whole aeronautical world. It is a convincing statement that has not taken definite form before. Ill-fated, fatalities have been accepted as a necessary part of aviation progress. This is the best particularly true in the fields of military and naval flying. But with commercial aircraft it was hoped that this phase would gradually become less associated in

the public mind. It is easy to criticize and blame after a misfortune occurs. But when the maker of the airplane that have powered all the great trans-oceanic flights terms a venture as "white" it is time for serious thought. The Department of Commerce aeronautics division did all it could to prevent a catastrophe by requesting ciders and further inspections. But they were over ruled. In the future, where large financial rewards are offered, it is to be hoped that adequate safeguards will be a part of the requirements.

The Skilled Mechanic

NOW THAT THE business of building airplanes has reached the point where factory standardization and regularity of production is essential, or if not, will be in the very near future, the services of the skilled aircraft mechanic can be used in experimentation and development work alone.

In days gone by when planes were built individually or in small lots, the details of construction were often left to the judgment of the skilled mechanic. And for such work he was highly paid as it required a high degree of ingenuity and ability. But with the inauguration of modern labor saving tools and production methods, the same quality of product can be obtained at a lower labor cost.

However, there is always the need for improvement, and as such is easily possible through practical research and experimentation, the skilled mechanic is just as much in need now as before, if not more so, due to the progress of aerodynamical engineering. And added to that there is the matter of repairs. That is itself is a work that demands expert ability if it is to be done right, for, after all no airplane is an engine in destruction proof and it is the quality of repairs that adds or detracts from its performance.

Good Planes Make Good Pilots

THERE WAS a time when the small amount of capital involved in the purchase of war surplus planes allowed incompetent pilots to crash planes with comparatively little financial loss. The same extent this condition will continue to exist, for there is no way of preventing second hand planes being sold at a low price before they are finally scrapped. Where there are comparatively small financial losses involved in case of crashes, nervous or bad fliers can still continue to operate, but with new and higher priced planes the situation changes. Poor pilots are unable to operate good planes for the simple reason that they are too expensive to replace if they are crashed up. The better the plane the better the pilot must be.



The Western Air Express

By EARL D. COSBORN

WHEN IT was first decided to extend the government as well as the West Coast it was quite evident that the route should go to San Francisco. At that time it was considered probable that the next step would be to run a line by a northern route to Seattle and another route through the South to Los Angeles but when the time came to let and routes to provide consideration it was decided by those in charge that it was too early to start down transcontinental air mail routes and that it would be better to split the transcontinental line at Salt Lake and run one branch to the North West and one to the South West. The wisdom of this decision has been proved by the success of the two branches. The northern line is called the Western Air Express and it runs from Salt Lake City, Utah, to Los Angeles, Calif., a distance of 888 mi.

Regularity of Operations

The most salient feature of the Western Air Express is the extraordinary regularity of its operations. The line was opened for scheduled flying on April 17, 1926, and during the following year approximately half a million miles were flown, including test flying and ferry work. Of the 538 possible trips which were scheduled for the year's operations, only nine were defaulted, two of the delays being due to engine failure and seven being due to bad weather. This is probably a world's record for regularity of operation of a line of such length.

The chief reason of the company for the carrying of mail, although passengers are also carried. During the first year 125,000 lb. of mail were carried. This works out to be approximately 360 lb. of mail a day or 175 lb. in each direction. The mail is flown largely from the neighborhood of Los Angeles and a very considerable part of it is supplied



Leading Captain Graham's plane with its mail at the Los Angeles Airport, by the moving picture industry. The W. A. E. also carried 308 passengers. Several special charter flights were made but this end of the business has not been developed to a large way.

The route of the air line has over almost every and practically unobstructed country. The region is so barren that it was some fifty years before any of the planes was able to penetrate from Utah to California. Most of the route has been a very broad and unpopulated valley part of which is flat and part of which is very hilly and broken up by small canyons. At times the line of flight crosses the plane over some rather high tops of mountains but for the most



Harrie H. Henshaw, president and general manager of the Western Air Express.

part the plane is within gliding distance of valleys which are more or less level. The average slope of the flight is on large and better known.

The best time was four hours ten minutes and the current two hours and forty minutes. Most of the flying is done at an altitude of over 8,000 ft. and as the engines are run at comparatively slow speeds (1450 rpm.) their life and reliability are considerably increased. The weather over the route is on the whole excellent. The most serious difficulty in the Los Angeles Personal where some day comes in over the Salt and make the take off and landing difficult. In the mountainous regions high winds are encountered and over the desert, rising columns of heated air make the going very hazy. During the day the snow storms occur but except for this the visibility is almost always good.

His Own Hangar at Salt Lake

Some thirty fields have been cleared along the route so that emergency landings may be made without trouble. There are the main fields at Salt Lake and at Los Angeles there is a field at Las Vegas at which a regular stop is made. At each of these three fields there is a wireless station for weather reports and progress reports on the planes. The planes themselves, however, do not carry wireless.

All Salt Lake the company has its own hangar which can house three or four planes. All the overhead work is done at the Los Angeles field. The engine overhaul shop is not very large but the work has been placed on a regular production basis and the shop is kept in a very orderly condition. The passengers are carried over every 200 or 300 miles in a hour period between overhauls for an engine such as the Liberty and is assembled for partially by the high efficiency and subsequent low compression, and partly by the fact that the engines are kept thoroughly dry down before they are run again. The second for reliability of the W. A. E. mail has not been accomplished however without the very best of maintenance care and thorough scheduling of the

engine. In fact before the engine was put into service nearly a thousand dollars was expended for new guns, steel bulletproof and many other improvements. Some of the engines have gone as much as 2000 hours without replacement. At the moment of flying time is very exacted the cost of the engine goes on in a very narrow manner, one engine being overhauled about every two months.

So far there have been no crashes or major overhauls and the maintenance of the planes has been done at Los Angeles. A very careful check on gasoline consumption is made and by going over the records the management can tell whether the engines are functioning properly and whether the planes are keeping their properly identified down. When a plane comes in after a flight it is immediately prepared for the next trip. The planes are very thoroughly inspected and if the maintenance standards have any extra time they go to work cleaning the planes. As a result the planes always look as if they were in the condition and the personnel has something to do, and there is not the appearance of confusion which is so prevalent at most airports.

Mr. Henshaw Formerly in Automobile Business

Harrie H. Henshaw who was formerly in the automobile business on the West Coast is president of the company. Max C. G. Moody, of young days, is a vice president and supervisor of the flying operations.

James O. Wender, there are eight mechanics. Four pilots do 90 per cent of the flying. They are Maximo Graham, Alvin the Green, "Jimmy" James and Fred Kelly. There are also two reserve pilots. Graham and the Green have some years' experience and have been near death several times. James has specialized in studying the air currents and as a result his average time over the route has been faster than that of any at the other pilots. The pilots of the W. A. E. average nearly 30 m. of flying a month which is a very high amount. Flying, however, is their sole duty and outside of making repairs they have nothing to do with the maintenance of their planes. In fact, when not flying they are asked to stay away from flying field.

At the very outset it was realized that traffic was the most problematic element in the operation of an air line and every effort was put towards the development of the business of the air line. At the very outset, the service of Chambers of Commerce, rotary clubs and other civic bodies



Reproduced photograph of a W. A. E. mail plane in flight.

was solicited, and a campaign appealing to the patriotism of Southern California was started. The results were most successful. Every business was supported, and all hotels and restaurants day closed or used airplanes and stamps. Southern California has certainly been made more aware of the existence of the mail line via the western part of the United States. As a result, almost from the very beginning there was very considerable loads available. The passage of mail showed a steady increase throughout the year



Left to right: Alvin the Green, Max C. G. Moody and Captain Graham just before the take off of the first flight on April 17, 1926.

with a sudden jump at the time when the last week of the year was established. Traffic however can only be worked up from the Los Angeles end as there are no towns there is so small to be situated along the route. The passenger business has not been pushed to any very great extent but the planes are all of the open cockpit type. The greater part of the passenger traffic has been from Los Angeles, and as it was easier to select passengers from the main terminal there than from Salt Lake. The planes going out almost invariably start on time but the west bound plane must wait for the government mail plane from the east, and if there is bad weather between New York and Salt Lake the plane is apt to be late, a fact which has caused considerable inconvenience and has forced many trips to be delayed which of course is a great detriment to passenger service.

The taking over of the San Francisco-Chicago line by the Boeing company which has the very best of equipment should increase the regularity of arrival of the transcontinental service at Salt Lake and therefore help the W. A. E. Work has already been begun on the right lighting of the Salt Lake-Los Angeles route but as the present transcontinental line from Chicago to Salt Lake at night it would not be advantageous to start night flying over the W. A. E. route until a daylight service is put in between Chicago and Salt Lake. The W. A. E. is still comparatively a passenger line between Los Angeles and San Francisco, and though planes are still available they may not have effect in the carrying of passengers between Salt Lake and Los Angeles.

Seven New Gas Cells for the Los Angeles

The first of seven new gas cells for the most striking "Los Angeles", now being manufactured by The Goodrich Tire & Rubber Co., Akron, O., will be completed and delivered to Lakeland Air Station flying August. It was announced recently by the Goodrich executives department. The other cells will be ready for installation before January, 1928.

An experimental airplane landing and releasing device for the Los Angeles is now under construction at Goodrich for the Navy Bureau of Aeronautics, and tests may be made during the early Fall.

Duralumin—Defects and Failures

By LIEUT. COMDR. WM. NELSON (C.C.) U.S.N.

ONE OF the advantages of metal over wood as an aircraft material is the uniformity of the metal. There are no shakes, checks, knots, spiral grain, etc., in metal; and, as a consequence, aircraft builders who are not backed forward by the use of duralumin will admit that their hopes were not entirely confined at first reached from the inherent property of duralumin of having more uniform

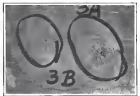
texture. The wrought and extruded forms do not in a rule have the grain-like appearance, being finer and providing more resistance to tool action.

Perhaps one of the most widely discussed points regarding duralumin sheet is the question of surface coloring. The normal color in its surface appearance from a given alloy group is a dirty gray with all colors of the rainbow superimposed. The clean shiny gray resembles a polished piece in other respects the dirty gray may be developed as dirt rubbed into the metal. When looked at from an angle there are some times to be seen on the polished surface varying perfectly concentric or in some a spot and mottling uniformly at other times. These have been described as "tiger" and "leopard" and have been definitely ascertained by numerous tests that some of these changes are only leaning on the physical properties of the material, not in the shade of gray a measure of impurities. These, on the other hand, may be due to surface conditions are accompanied by imperfections in the surface. These imperfections are usually the result of contact with some foreign substance after the material has left the mill. Duralumin on market should not find its way into aircraft under any circumstances if the surface imperfections, other than the color, are observed.

Surface Material Inspection

The imperfections inspected for on duralumin in the raw state, aside from mechanical properties are lamination, cracks, pits, dirt, scratches, buckles, blisters, dross, oil marks. Most of these when used should have little effect on the physical properties of the material, but are not desirable for other reasons, including as they do more means better dangerous than the only by the use of a microscope or the X-ray.

Lamination occurring in a part of a sheet or shape have been more frequent in the past than in the case now. Freely rolling of sheets resulted in a condition where the sheet could be separated for a considerable area into two thicknesses with no load between the two. Fortunately this defect occurs in the edge where it is readily discovered if important.

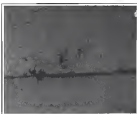


Lamination in a duralumin sheet. The photograph is slightly magnified.

but there are cases where the sheets have been joined together so well that lamination was not found until the pressure operation had been completed. Consequently, lamination is a defect, being due to metal in the extrusion mold carrying over to the next following extrusion. It is never necessary to state that laminated duralumin is not suitable material for aircraft use.

Cracks in sheets and other rolled shapes are due to the temper of the material or to pulling of the rolls. Cracks in

the kinds of rolled shapes may be due to the thickness ratios of one face to a large beyond the other. In the material. Cracks in extruded shapes are usually found at the ends and are caused by the use of more of one end than is warranted. Chattering of the die or an imperfection in the die used for extrusion causes a series of cracks readily discoverable in the finished product. Although these defects are not always found in duralumin in general, cracks in tubing should be noted.



Cracks in and near the surface, due to improper working of the metal.

from aluminum material with extrudates. Pits and lathes can be seen with little difficulty in an advance check duralumin sheet. It is practically impossible to avoid some pits and lathes in rolled duralumin. They are due to dross or foreign substances picked up by the rolls subsequently rolled into the metal, will appear from time to time and when the material is stressed on these results will be expected. Corrosion does not develop in these pits nor of the corrosion unless it happens to be foreign matter, in which case the corrosion of the duralumin may or may not be harmful. As a rule pits and lathes are not cause for rejection unless the quantity or frequency warrants such action.

Scratches due through handling of the material. They are not deep enough as a rule to do other than mar the surface, but they have a bearing on corrosion and fatigue failure. Corrosion will necessarily along a scratch if the point of duralumin is exposed, as it is to the extrusion of lathes to avoid whenever practicable all scratching in duralumin. Manufacturers of aluminum shapes now go to great lengths to reduce surface abrasion caused by environment in handling, and it is well if manufacturers take equal care to return the finished surface.

Buckles Appear in Sheet Stock

Buckles appear in sheet stock in quantity after last testing. These buckles are noted on by the strengthening roll which is the last and question prior to packing. Buckles in plates indicate difficulties in fabricating parts therefore aside from the effect on appearance.

Reverses may make their appearance as extruded dross, rolled in fibers of metal, or as a thin shell on the sheet or roll. Dross caused over by the rolling operation in dross out in the direction of rolling and adhered rather firmly to the sheet. The same is true of rolled in fibers of drosses or duralumin which may be picked up by the rolls. Reflection of the light on account of the working of the dross results in a silver. Material left in the chamber of an extrusion press by a previous upset makes its appearance on the extruded shape as a silver or a thin shell. All types of dross reduce the value of the product for general use and is not

they are extensive on part of the sheet or shape is acceptable. The complete condition of dross by breaking or grinding requires the material of considerable removal, making it a rather doubtful decision for the part affected.

It is believed that blisters should be segregated into two groups, those resulting from normal heat treatment and those resulting from overtreating the metal. Blisters on duralumin in the heat classification have no effect on the mechanical properties of the material. These blisters are small and not frequent. Blisters that make their appearance as overtreating material are a serious indication of change in the conductivity and selective physical properties accompanying such treated metal.

Overheated Gas Forms Blisters

In the course of the manufacture of duralumin, it is hardly to be expected that all involved gas in the liquid in dross. Naturally there is a certain portion of this gas will find its way to the surface or near the surface in a sheet or shape. Upon leaving the drossing tank heat treatment this gas will tend to expand and in some cases blow holes. Heat treating the metal at 350°C. will bring them out and it is only by subsequent rolling that the thickness of the sheet is restored. It is an opinion that sheets displaying a tendency to blister can be rolled first prior to the final rolling. Blisters on badly oxidized duralumin have been subjected to heat treatment and the indications are that no concentration of corrosion at the blisters is observed.

On the other hand, if duralumin is heated to a temperature near 350°C. there is apparently a change in the constitution of the constituent indicating very strongly the beginning of the rolling. This change according to the theory expressed may be accompanied by the formation of rolling blisters which in some instances may be avoided, but they do point out changed physical properties. The great result of over-heating is a perceptible drop in the elongation.

It is not possible to distinguish between the two kinds of blisters by a visual inspection, or at most an observed amount of blustering is occurring it is best to suspect the possibility of heat treatment and if that is correct it is a matter for the makers of the new material. It is not in the best interests of duralumin to lower the heat treating temperature to reduce blistering effect.

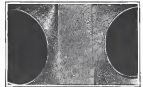
Roll Marks Denote Uniformity

Roll marks are depressions on the direction of rolling that may or may not be accompanied by transverse scratches. These roll marks destroy the surface finish and the uniformity of the part and should not be unusual in amount. They are caused by improper design of rolls or by defects in the roll surface.

Roll marks and scratches in duralumin come primarily from the methods of fabrication used. Careful handling and manufacturing will avoid as much of both.

Cracks due to mechanical restraint with a lot of imperfections show down the center. These imperfections include corrosion pits and are due to the method of heat treating such duralumin rolls. The rolled sheet is usually rolled in the mill by the use of large extrusion rolls. The rolls are not perfectly round and the rolls are not perfectly round. This condition may appear as more or less pitting of the sheet while it is in the bath. Imperfect rolls have already been discussed.

Reverses may make their appearance as extruded dross, rolled in fibers of metal, or as a thin shell on the sheet or roll. Dross caused over by the rolling operation in dross out in the direction of rolling and adhered rather firmly to the sheet. The same is true of rolled in fibers of drosses or duralumin which may be picked up by the rolls. Reflection of the light on account of the working of the dross results in a silver. Material left in the chamber of an extrusion press by a previous upset makes its appearance on the extruded shape as a silver or a thin shell. All types of dross reduce the value of the product for general use and is not



Duralumin sheet badly oxidized by overtreating in the heat treating operation.

defects that roll over and under the surface in the direction of the metal. Experience with this aluminum alloy shows its resistance to aircraft has been to get the same in order though, so that at this present time the advantage mentioned is recognized as a field of importance.

It is proposed in this paper to identify some of the defects and failures in duralumin most frequently encountered by the aircraft industry with a view to reduce their importance. Numerous cases have been called to the author's attention where the defects have been reported, whereas, on the other hand, usual inspection has revealed material not found for use as structural members in aircraft. To distinguish one from the other is not always quite as simple as it seems.

The defects and failures in duralumin may be classified into the following groups—

- (a) Defects produced during manufacture of the raw material.
- (b) Defects produced during fabrication of the material into parts.
- (c) Corrosion failures.
- (d) Fatigue failures.

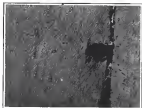
Only the first two will be covered in this article since each of the others are far too important to be given other than detailed attention.

The methods of manufacturing duralumin have been so standardized and so rigidly supervised by the producers of this metal that unusual defects therein are exceptional. Extraneous effects by the processes of treatment and in some instances have been referred to the material produced so that at the present time the means of most of the defects occurring are known, and corrective measures are suggested before the material is distributed. However, duralumin is not all the aircraft designers and manufacturers would like it to be, nor is the product always to be developed on good, far in spite of scientific production and hard work requires the manufacturer to sometimes require to make decisions regarding "the use of the metal".

As is known, duralumin is available in solid, wrought or extruded form, and in various conditions of thermal treatment. The rolled duralumin usually comes in the form of sheet or coil. The surface, such a surface being produced by the rolling operation.

more active than the other parts of the rivet. It is desirable for the rivet manufacturer to construct as in the question of standard rivet heads.

The most common serious defect in duralumin being fabricated into parts is a crack. These cracks are primarily due to stressing the material by working it too long, too cold, and too hard. They are frequent on parts drawn or pressed or shaped and stressed in one from very minute cracks to complete parting of the material. Such break as a very small notch in preparation to the thickness of the material will tend to crack inside outwards. The size of the cracks or their frequency determines whether or not the material can be used for the purpose intended. In some cases the cracks



A crack resulting from the removal of an inclusion in a duralumin sheet. Duralumin highly textured.

attitude of the material is responsible for the cracks but in most cases it is due to the design or to the stress imposed. Should modify these cracks if at all at sharp bends. Sharp bends may cause cracks at sharp bends as at any part that has been worked too cold. Great precautions should be exercised with a negotiating plane to be covered that no cracks exist. During duralumin or a similar metal solution will tend to make cracks more apparent and it is a precaution against the use of an aqueous solution in forging.

Sometimes, bubbles, blisters and tool marks in duralumin are other defects that come in the fabrication of parts. Bubbles and tool marks are largely avoidable by proper care in handling. No particular advantage accrues in rubbing out these defects with emery cloth or steel wool.

Buckles Can Be Prevented

Buckles can be prevented if desired by machining the part in an oil bath instead of water or oil. Buckles will be the most serious in the case of most rapid cooling when in practice it is quenching in cold water. The working out of buckles within a short time after the last finishing operation is a common practice and is not known to be injurious to the material. Some method of stressing the sheet into place or across surfaces would be of great advantage from the appearance point of view. With the present methods in use, the buckles in the sheets are sometimes as open to objection and appearance objections that fabric maintains its position as a wing covering.

In discussing the question of rivets further it might be mentioned that defective rivets are, as far as the aircraft industry is concerned, up to the riveter. Rivet rivet passes through the heads of the riveting screw and is open to their inspection both before and after being driven. Cleaned heads and washed joints are readily accessible to this crew and their whole-hearted attention is necessary to insure good jobs. There is another factor connected with rivets which demands attention in somewhat work and that is the question of fitting up the rivet holes. Correct bolting and nutting are essen-

tial. The complete driving of the rivet as to fill the hole as a matter worth devoted attention. The few observed with properly head-treated rivets is considered to be good. In general, practically anything within reason can be done with duralumin rivets but a rivet job is usually the result of the care that should be taken to the place of assembly work.

A defect usually produced in duralumin by the anodic oxidation treatment is that of having the metal by using too great a current density. Duralumin which has been so treated is very weak and will not serve any useful purpose. The prevention is dependent entirely on the current control during the treating operation.

Proper Heat Treating Essential

When the aircraft designer specifies duralumin for a part it is done with a view to having material that comes up to certain physical or mechanical values. It is therefore incumbent on those working in the design of parts to know the full range with all operations leading toward that ultimate. Perhaps the easiest place to make errors that will also be the desired results is in not having properly heat treated duralumin in the final assembly. Anodized and cold worked duralumin will both find their way in as best treated material unless care is taken by rigid inspection. The simplest arrangement to check the parts is by means of the anemometer. Properly heat treated and aged duralumin will give a anemometer hardness of about 95 whereas the anodized material will give a value considerably lower and cold worked slightly higher. To be more certain than the hardness values will indicate, bend tests should be combined with the hardness determination.

Duralumin, which has been treated in the finished treatment is readily detectable to the eye. Extreme brittleness is a satisfactory feature in material which has been too hot. There is no recovery for a burnt piece of duralumin.

In conclusion it can be stated that the success of duralumin rejected due to defects and failures is not great compared to the question however of in other aircraft material, but there is no remedy the possibility that an undesirable piece will find its way into the finished airplane as it is essential that due diligence be exercised by those in control of this factor.

For Ladies Only



The Chicago Flying Club has a women's auxiliary called the Women's Flying Club in which is enrolled the largest class of military women pilots in the country. A total of 110 girls from 17 to 30 years of age have been accepted as members. The president of the organization is Mrs. E. Loren Campbell who is also an officer in the other system. Photo shows Mrs. Campbell (far right) giving the class a few pointers on the correct use of the controls.

The Gordon Bennett Balloon Races

Sixteen Entries Representing Eight Different Countries Will Race for International Trophy at Detroit, Mich., on Sept. 10

ONE OF THE greatest international events of the year is to be staged at Detroit, Mich., on Sept. 10, 1937, at 8 P.M. At that hour 16 free balloons bearing a gross weight of 1,200,000 sq. ft. and representing eight nations will "take the air" in the sixteenth annual contest for the Gordon Bennett International Balloon Trophy. The contest is to be held in America this year, due to Wm. T. Van Orman of Akron, O., winning the 1934 event, the rules of the contest providing that the nation winning the contest the previous year is awarded the contest for the following year.

The entries for the 1937 class, as announced by Ray Cooper, general secretary, are: United States, 3; France, 2; England, 1; Spain, 1; Germany, 1; Belgium, 2; Switzerland, 1, and Italy, 2.

This is the first time since 1923 that German balloons have competed in a race of this nature. Again from the fact that America is honored by being appointed the starting place for the 1937 contest, she will also have the honor of assisting Swedish balloonists, who will come to this country as representatives of the nation having entries in the Gordon Bennett Race.

Three American Entries

America this year will be represented by Wm. T. Van Orman, winner of the 1934 Gordon Bennett Balloon Race, and the 1937 National Exhibition Race, recently held at Akron for the purpose of selecting the American representative in the 1938 Gordon Bennett Balloon Race. Van Orman is presently recuperating throughout the world as the outstanding hot balloonist, and it is America's hope of winning the coveted trophy. The second team will consist of E. J. Hall and A. O. Redhouse of Detroit. The team of two is consequently new to the art of free ballooning, and placed second in the Exhibition Race. Again this year, the race will have the support of the U. S. Government through the medium of the U. S. Army, attached to the contest, and in the control of the balloons, and will be piloted by Capt. W. R. Knease and Lieut. W. O. Knease. The Army entry finished third at Akron during the Exhibition Contest.

Although balloons have been in use for over a hundred years, it is a noteworthy fact that organized competitive ballooning originated in France. It was in that year that the late Jean Baptiste de la Motte, a Frenchman, placed in the control of the Army Club de France, the first trophy bearing his name.

Distance as Winning Factor

The first contest for the Gordon Bennett Trophy was held on Sept. 28 of that year and was won by Lieut. Frank P. Lahm who flew a distance of 442 miles from Paris, France, to Southampton, England. The conditions under which the contest has been held have not been changed since originally devised up, and the outstanding provisions are that each entry has time limits, being an air capacity of not less than 100,000 sq. ft. each. The time in the air, altitude, etc., are not factors in determining the winner, but the whole and entire contest is based on distance flown. The contest was first held in 1906, and has been staged each year, with the exception of the time between 1913 and 1920, when it was deemed advisable to discontinue competition of the particular nature, because of the World War.

The Rules of the Deal of Gift for the Gordon Bennett Trophy provide that it is in order for the Trophy to become the permanent property of any nation, the contest must be won on three consecutive years. The contest this year is for the second Gordon Bennett Trophy. The first Trophy was won by Ernest Dennerfer of Belgium, who was the winner in the 1923-1925-1926 classes. Because of this wonderful achievement by Dennerfer, the people of Belgium possessed



Wm. T. Van Orman, American ballooning champion, making out of a balloon's cockpit.

a trophy by popular subscription, and entrusted it to the Army Club de France, it is accepted for under the same conditions as the first trophy.

In preparing for a contest of this kind, there is a great deal of detail and preliminary work. The Ford Trophy, which has been awarded by Henry Ford for his great race, is a case of such activity just at present. Reports of race news being having gone lower for the millions of the balloons and several competitors are engaged creating a sense of grandness for the contest which will undoubtedly climatic conditions should be a great success.

A new \$50,000 to \$100,000 balloon replacing the former "Goodhue 111", was made at the 1934 and 1935 National Races and the 1935 International, will be used by W. T. Van Orman and W. M. Morton, Goodhue pilots of Akron, in the 1937 contest.

The "Goodhue 111", as the newly-completed racing bag has been named, will incorporate all the improvements in the art of balloon construction learned by the Gordon Bennett competition in more than 15 years experience.

On single pilot construction, the amount of American's previous racing pilots will probably be the lightest balloon ever to represent America in an International event. The radio equipment and the master's control will again be employed as wireless devices by the Akron men in the Detroit race, it is believed by Van Orman, who maintains that the race is first place in the last National Race was largely possible through the use of these means of position finding. Van Orman expects to see the 17-pound radio receiving set which has been with him in three contests since the 1924 National Race from San Antonio, Tex., which he expects to see his next trip to Europe during the last five years.

Aircraft Trade Notes

N.A.C.A. Publishes Pitot Tube Report

The National Advisory Committee for Aeronautics has published report No. 264, entitled "Differential Pressure in a Pitot-Static and Pitot-Static Tube over 300 deg. pitch and yaw," by R. M. Barr. The report contains measurements of the differential pressure on two Navy airspeed meters, consisting of a Rahm type pitot-static tube and a 34-56 type pressure pitot-static tube. The tubes were placed in a tunnel simulating of fluid speed at various angles of pitch and yaw between zero degrees and 300 deg. The results show that for a range over 30 deg. to +30 deg. pitch and yaw, in-



National Advisory Committee for Aeronautics air test wind tunnel work on standard tubes.

strated air speeds varying from the indicated speed at zero degrees vary slightly over two per cent. for the Rahm type and about one per cent. for the 34-56 type.

For both types of airspeed meters the indicated air speed decreases slightly as the tubes are pitched or yawed several degrees from their normal zero degree attitude. It attains a maximum around pitch or yaw of 25 deg. to 30 deg., declining rapidly thereafter as pitch or yaw is increased, to zero at the velocity of 30 deg. to 180 deg. and thence then fluctuating irregularly from three-fourths to plus or minus 180 deg. The complete curves for differential air speed for the two tubes over 300 deg. pitch and yaw is graphically portrayed in figures.

For the same air speed and zero degrees pitch and yaw the differential pressure of the Rahm type pitot-static tube is about twice as much as that of the 34-56 type pressure pitot-static tube.

Report No. 264 may be obtained upon request from the National Advisory Committee for Aeronautics, Washington, D. C.

Wide Use of Perry Austen Dopes

The Perry Austen Mfg. Co., of Grossepointe, S. I., N. Y., pioneers in the manufacture of airplane wing dopes, have had their material used on most of the planes which made the recent flight.

On the Loening Amphibian, which made the 15,000 mi. Coast-West flight in South America, the company's Clear Airplane Dope, an undercoat, and the Finestolite Dope, an topcoat, were used on the fabric. The Wright-Dixson

monoplane, in which Clarence Chamberlin and Charles A. Levine flew to Germany, and the Fokker monoplane in which Claude G. Bush and E. J. R. Smith made the trans-Atlantic flight, and Louis J. Boucher and Albert Hegenberger the trans-Pacific flight, also used the Perry-Austen dopes.

The Vought "Corsair," in which an admirable and three speed monoplane have been established employed this airplane dope.

Report on Friction of Aviation Engines

The National Advisory Committee for Aeronautics has published Report No. 262, entitled "Friction of Aviation Engines" by S. W. Sparrow and M. A. Thomas. In the first section of the report, it is concluded that: (1) Changes in friction due to changes in temperature of the air entering the engine are negligible. (2) Changes in friction which result from changes in atmospheric pressure are due primarily to changes in gaspacing loss. (3) The increase in friction resulting from a decrease in throttle opening is due to the change in gaspacing loss. (4) For speeds from 1,000 to 2,500 r.p.m. the friction as a percentage of horsepower increases with speed. Ordinarily the percentage increase is less than the percentage increase in speed. At low engine speeds the friction due to gaspacing is much less in speed and it remains practically constant in amount. (5) Friction depends upon the viscosity of the oil upon the cylinder walls. (6) The increase in friction with compression ratio is very slight.

The second section of the report deals with measurements of the friction of a group of pistons differing from each other in a single respect, such as length, diameter, area of skirt face, location of skirt face, etc. Results obtained with each type of piston are discussed and attention is directed particularly to the fact that the friction attributable to piston rings depends upon engine design as well upon ring design.

Report No. 262 may be obtained upon request from the National Advisory Committee for Aeronautics, Washington, D. C.

New York and Western Airlines, Inc.

New York and Western Airlines, Inc., Rochester, N. Y., has been incorporated under the laws of the State of New York for the purpose of transporting passengers and freight and mail.

The corporation controls the operation of a 300 acre field, known as the Ramo-Portage Field where the flying service used instruction are now being carried on daily.

The officers and directors of the corporation are: Capt. Merrill E. Widdick, president; E. Ross Douglas, secretary; Charles E. Clapp, treasurer; James Thompson, director; and Harold Martin, assistant secretary. The executive office is located in the Granite Building, Rochester, N. Y.

Western Aero Firm Partnership

Lawrence Thompson of the Mohawk Travel Air Lines Co., North Platte, Neb. assumes a partnership with Otto R. Radial. The company is engaged in the sale of Travel Air planes, commercial flying and instruction and also conducts an airplane service station, doing emergency repair work.

TEN YEARS of LOENING PIONEERING

1917 - 1927

TEN years ago — on August 10, 1917 — Grover Loening and Henry M. Crane founded the Loening Aeronautical Engineering Corporation.

In the decade that has passed, this organization, always original in its designs, has pioneered many outstanding types of airplanes, beginning with the first rigidly braced monoplane, the record breaking Loening two-seater fighter of 1918 which carried this type of monoplane, now so widely used, to a high degree of success.

Several years later, in the Spring of 1921, the first American monoplane flying boat appeared — the Loening Air Yacht — a novel type of plane, disclosing the Loening form of wood frame, metal covered hull construction and combining for the first time a vent hull and body.

The Loening "composite" hull construction and the vent hull and body combination, together with the development of inverted and radial engines, made possible in a logical sequence of development, what is one of the World's most distinctive and successful airplanes — the Loening Amphibian.

The first Loening Amphibian was flown in 1924 and since that time the Loening organization, with its corps of skilled craftsmen, its wealth of experience and its fine plant facilities, has concentrated on this type of airplane.

As a result American Aviation therefore boasts of the World's finest Amphibian, — proven by service in the Arctic, in the Tropics, around South America, in the Philippines, Hawaii, Panama, China, Alaska and all over the United States.

LOENING AERONAUTICAL ENGINEERING CORPORATION

(Founded 1917)

1101 STREET AND EAST RIVER, NEW YORK CITY

AIRPORTS AND AIRWAYS

Rochester, N. Y.

By Joseph F. Farns

Rochester is planning an aerial exhibit in conjunction with the upcoming annual Rochester Exposition the week of Sept. 5 to 20. Plans are now underway and several aviation companies have been invited to exhibit their products. The exhibit, the first of its kind in this part of the state, is being sponsored by the Rochester Flying Club and the Rochester Municipal Museum. An entire floor in the museum building will be given over to the exhibition.

Considerable interest has been aroused through the advance publicity given the exhibit and it is expected that nearly 100,000 visitors will attend from all parts of New York State as well as neighboring states and Canada. According to records the exposition in the past years have attracted between 80,000 and 100,000 visitors.

One of the first exhibits in the Rochester Exhibit Company, which will have a display of several early and modern types of aerial cameras, Clark-King Aerial Survey, and North Star Aerial Service, Inc., displaying two Taylor monoplanes, one fully equipped and one in outline.

The Aerial Exhibit Committee, of which Gordon A. Taylor is chairman, and Harry C. Woodell of the museum arranged that applications for display space will be received until Saturday evening, Sept. 3. There will be no charge for space, and all that will be required of the exhibitors will be to erect and place their exhibits. Applications will be received by the

secretary of the Flying Club at 58 East Main Street, Rochester, N. Y.

Hadley Field, N. J.

A radio-beacon has been installed at Hadley Field, sponsored by the General Electric Co. The installation consists of a wooden mast 90 ft. high, fitted out with a Radio-Tel type directional antenna. A wooden building 13 ft. by 17 ft. has been erected at the base of the mast. The transmitter is one k.w. tube set working in the apparatus used for radio beacons of the Lighthouse Service, modified by the installation of a generator and automatic sending loop for the radiating signal. Ground tests have been made and the apparatus has been adapted to produce a smooth signal pattern and interlocking radio beam. The radio interlocking beam is carrying at Hadley Air Mail Field, making it possible for airplanes equipped with radio receivers to determine their direction in the field under conditions when bad visibility prevents flying with safety.

The General Electric Company has developed a radio receiver for the Lighthouse Service to be installed in the small air mail planes and to be used in conjunction with the radio-beacon. The receiver is 16 by 12 in. in size, 3 in. thick, weighs 8 lb. and is the first commercial development of a suitable airplane receiver built especially for use and places where compactness, reliability and weight are important factors. An



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granted there is naturally adapted, is level and has good drainage. This was an old strand for poppy fields in the past.

The student courses included in the company's program was started Aug. 20 with the opening of a ground school under pilot Deane. A number of students have already signed up.

Springfield Airlines, the other commercial company here, received two shipments of Stinsons and said there almost before they were fully assembled. Henry Herman, pilot and instructor, expects to arrive three more shortly and prospective customers are waiting their arrival. Walter Johnson of Hartford is making parachute jumps at Dana Field, the company's airport, every Sunday and here crowds admire the airplane as it soars in the air. Johnson also has a Stinson VI, recently in late pattern of the Stinsons and an airplane and an airplane. Johnson has done considerable aerial photography and has derived several successful aerial photos.

"Aviation Week" will be observed coincident with the air program scheduled for Sept. 2, 4, and 5. Harold F. Banks, its manager and one of the promoters of the most experienced recently that the program that encompasses nine special window displays and otherwise feature "Aviation Week" has been approved by the Springfield Chamber of Commerce. Banks was a pilot in the R.A.F. during the war and at one time was an instructor at the Army Field at Gageport. He and his Army plane will have shown at this state a few days ago.

One of the features of the week will be the appearance of Major Fleeming, a former R.A.F. "ace" and Baron Bruce H. A. Burslem, who is a member of Bushfield's Green. It is expected that they will appear together in a parade display during the program. Bruce Burslem is a former Stinson's manager and has most recent landing in the Stinson they present their flying the Springfield engagement. Banks hopes,

however, that the "Flying Panacea" will be able to appear in a hazy plan if the Panacea could be revised.

Plans to put Springfield on the air mail route are progressing rapidly. The Chamber of Commerce is looking the plan in the first and preliminary arrangements by many firms and individuals indicate that the service would secure at least the maximum support necessary. The efforts of Lloyd L. Anderson and G. A. Parsons, adverse traffic manager of the Colonial Air Transport Company, an interesting business men of Northampton, Holyoke, Westfield and Springfield have met with encouraging response. The Chamber of Commerce intends to distribute ideas to business houses and manufacturing plants asking them to indicate their support in the request with an indication of the volume of mail they would guarantee to contribute. The city is asked to guarantee 20 in of mail daily and the other cities must supply no other 20 in.

The company proposes to use a Fokker Universal which would park up east at Northampton, Westfield and Springfield and connect with the Hudson-New York plane at Hartford early in the morning. The plane would return to the city morning. This service would connect with the trans-continental route at Holey Field.

Miami Airport Christened

By Harold M. Wade

Headed by Mayor E. G. Sewell, a large crowd of Missions assembled on Hialeah Airport field, took a great demonstration of volume on the arrival ceremony of the Royal Typewriter "Air Transport" piloted by John A. Collins, who was on route from Hartford, Conn., to Havana with a cargo of 150 typewriters.

After getting his bill of lading and delivery sheet properly signed by A. G. Dwyer, Miami manager for the Royal Typewriter Company, Pilot Collins, who was in the meantime, Wad, showed the large welcoming committee all about the

large aircraft, explaining details of construction and points of importance.

Accompanying Mayor Sewell in the welcoming line were Mayor Luma and Graham of Miami Beach and Hialeah



Chamber of Commerce at Hialeah airport, Miami, Fla., welcoming air express, an 1500 lbs. mail freight to Miami, Conn.

representative, and J. E. Young, E. C. Matson, C. H. Bader, Mayor George Blair, L. E. Goodrich, F. C. Latham, E. J. Schard, E. M. McLean and Samuel Decker.

A week plane owned by Ronald Reicher was in the air sometime prior to the arrival of the Royal Air-Transporter and made an attractive sight for those on the field.

Mr. Collins made two or three stops on route from Hartford and after his Miami arrival left for Havana.

J. E. Young, president of the Miami Aviation Club, ar-

ranged a reception for the plane and a large gathering of Miami business greeted Collins and West on the roof of one of Miami's leading business hotels.

From that point of visiting Collins was shown the first-class edition of Miami's extensive light industry and equipment, and he gave enthusiastically over Miami's opportunity to become the great airport of Southeastern America.

Duluth, Minn.

By H. A. Lushby

In order to create a more widespread interest in aviation and acquaint the general public with what is really going on at the flying field, the Arrived Airway sponsored an interesting two-day program.

Over 10,000 people witnessed the aerial exhibition and a number of the former display were known why flying in a safe manner of travel and not generally a safe show exhibition.

By itself, a well known about their was the location situation and performed a number of interesting feats for the crowd.

Max Mordecai, a Duluth pilot, provided a thrill for the crowd assembled at the field by carrying from the undercarriage of a plane.

This event was of special interest in the local people as more than 20 girls applied for the honor of being the dorsal girl and as her identity was not revealed until the last minute an imaginative crowd was guessing to who was selected.

N. E. Washburn, of the Golden Dawn Sportplane, in his straight jacket and was another feature of interest.

The Golden, a local citizen, was a loan for the children at the field when he completed his first parachute jump and this event was also of general interest to all as it was the first jump from a plane in this vicinity.

Walter Bellack, from Minneapolis, with his partner, Harry Sijbma, was on hand with their plane to assist with the stunts, passenger carrying and piloting of the photography

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Side Slips

By RICHARD S. INGRAM

Mr. R. H. R. read in the following letter, which he found in his mail recently. He didn't include his own comments on the letter, but it seems obvious that he wrote us to warn the readers of this magazine to be on the lookout for a gyroscopic glider which may be coming down for a landing any day now.

"Dear Sirs—

Would you be interested in buying or financing a machine, the mechanics of which are as follows:

Wing stood in nearly stationary air a bird

Can easily attain an altitude of over forty thousand feet within a speed of over 50 miles an hour.

Requires no upwind run. (Less than twenty cents a day while in operation.)

Very few fuel/air parts to wear out

Can be handled easily by a child of twelve, without danger to child.

Can land in a space forty feet square or less.

By extreme maneuvering can make thirty miles an hour against the wind.

Can be made to climb at an angle of over twenty five degrees without danger to pilot.

Cost of maintenance may be about the same as a Dushoff one, and the future would see a great utilization.

Can land on either water or land.

This weight of one ton is estimated, in proportion to the plans.

Has a very high climbing speed.

Believed to be done in also indicated. With a few supplies

I personally predict that it could be flown anywhere that one could desire to go.

My personal prediction is that this type of gyroscopic glider can be made, by the right person, as popular as the Ford is on the ground. The possibility of forming flying clubs using this type of glider is unlimited. If you are interested, I would certainly be glad to hear from you, or if possible talk it over.

I will answer one of the questions you doubtless will ask. I was a proud possessor of a model of this machine, and was unfortunately unable to set it for an altitude (think, and the way with which I said it failed for the test, broke, and to this date I have never heard any report of its coming back to earth. Be it as surprising that it just kept right on traveling. The date on which I lost the model was somewhere around February, 1936."

The most great popularity of aviation in general, and transoceanic flights in particular, with the newspaper and the public has brought out a new harvest of "popular" aviation magazines, some of which are certainly parts of literary endeavor. One of the featured of these appears in form of a page bearing an article on "The Possibility of Flying." The article is illustrated with a picture of Mr. Grover Wright in one of his early models which is labeled "Glorious Pioneer in The Dawn of Aviation", and some of the following astounding information has been gleaned from it.

"The airplane (as airplane) must move quickly before the force of the air has time to pull it down."

"A monoplane has more lifting power than a biplane, because it is lighter. In a biplane, the lower part pulls the upper down, with it that has more than a biplane does."

"The leading edge of a plane strikes the air first and thus always gives some concern to the engine."

"The tail and wings and other parts of the plane are built so as to increase resistance. This is why we have sea planes which enable us to fly to Europe in less than two days."

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PUBLISHER'S NEWS LETTER

Occasionally a book needs an epoch in its own endeavor. Usually, a new book is just another addition to the olden tale of the story of human knowledge. Of books there is no end. When the **AMERICAN AIRCRAFT DIRECTORY** made its appearance the month the aircraft industry may be said to have "arrived". Until then it was a miscellaneous group of unclassified news without a consciousness of its own. When it saw the new book, it was, indeed, its eyes, took notice of the extent of its ramifications and realized that it had at last become a part of the nation's business.

The **New York Times** is quoted to be the greatest American newspaper. It's editorial news are read in all parts of the world as a record of American opinion. However the books are usually segregated on a book page, but when the **AMERICAN AIRCRAFT DIRECTORY** was needed, it was realized that there was more than a book that required a review, it needed the acceptance of the aircraft industry. An editorial was written and placed in the most prominent position on the famous editorial page, a compliment that the publishers of **AVIATION**, who also published the last of the aircraft industry, edited from and published the **AMERICAN AIRCRAFT DIRECTORY**, greatly appreciate. Below is the editorial:

Progress of Aviation

Both military and commercial aviation and competitive flying for huge money prizes continue to have their thrills as well as their triumphs. The losses and failures and disappointments are doubtless inevitable accidents in the development of a new means of transportation, exposed to an enemy public. Yet the art and science of human flight through the air goes on making rapid progress and is now aided by all to have "arrived". A striking indication of this fact is the publication of the first "American Aircraft Directory". It is not only the **Aviation Publishing Corporation** and contains a wide range of information including operating air forces, pilot training fields, flying schools, manufacturers, together with a vast amount of other material well arranged, classified and indexed. If anybody doubts that aviation has come to stay, let him look over this volume of 176 pages. It is a work of more useful for selection and a support of progress.

The **AMERICAN AIRCRAFT DIRECTORY** is the first compilation, geographically arranged, of the American aviation industry—in personnel and commercial flying activities. The magnitude of the industry in the United States is reflected by the list and compilation in the **AMERICAN AIRCRAFT DIRECTORY**, a list beyond the usual can. Because the activities are widely scattered it is not generally realized that during 1936, long before the present wave of popular interest in aviation swept the country, there were in operation in the United States 433 commercial air service and transport companies, and that these companies carried 367,852 passengers, transported 797,676 lb. of freight, trained more than 1,366 students and kept 1,144 airplanes in service. These activities, of course, do not include the operations or demands of the military air service.

The wide scope of commercial aviation activities is adequately shown in the classified index of the Directory. Four hundred leading fields are described. There are 53 operating firms engaged in aerial navigation, mapping and photography. One hundred and eighty-five flying schools, most of them in the Middle West, are listed. There are 22 aerial crane and auxiliary concerns, and in the newly developed aerial business of crop dusting by airplane, eleven flying companies are engaged. Some 300 operators carry passengers or freight for hire. There are listed 66 builders of airplanes and 23 builders of engines, covering a wide range of activity from the extensive long established plants, whose products are known the world over, to the small plants whose output is limited to two or a dozen commercial jobs a year. These latter are by states and cities and include the names of officials as well as the products or attributes of the companies.

A compilation in the Directory shows 1,200 commercial planes in use on January 1, 1937. Airplane exports during 1935 are shown to have represented \$1,839,284 of which airplane motors represented \$561,958, airplanes \$107,095, and airplane parts and accessories \$145,100. In addition to the purely commercial aspect of American aviation, the **AMERICAN AIRCRAFT DIRECTORY** presents a directory of governmental air activities and personnel. Interesting features of the general aviation section of the directory is the listing of the educational institutions having courses in aviation, and a list of 235 graduate aeronautical engineers and university graduates who took the aeronautical courses. There is a compilation of the American Aces of the World War, and a complete listing of recovered World's and American airplanes and balloons records.

Amphibian Landing Gear Competition

In order to encourage the development of aviation and to improve the efficiency of aerial transportation in general, an act authorized by Act of Congress, Public No. 446, approved 2 July 1926, the Secretary of the Navy invites the submission to competition, by sealed memorandums, of designs for Amphibian Landing Gear for aircraft.

Prospective competitors will be furnished identical specific information as to the conditions and requirements of the competition and as to the various features to be developed, together with the respective measures of merit that will be applied in determining the merits of the designs submitted in competition.

All designs and accompanying data must be placed in the mails and postmarked not later than midnight 15 December 1937.

Information will be furnished upon application to the Bureau of Supplies and Accounts, Navy Department, Washington, D. C.

T. W. LEUTZE,
Acting Paymaster General of the Navy



"A Signpost of Progress" says THE NEW YORK TIMES



THE AMERICAN AIRCRAFT DIRECTORY can be obtained in two languages—in heavy paper the price is \$3.00 and in cloth, \$5.00. American Publishing Corporation, 716 West 57th Street, New York City.

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